



IMPROVEMENT OF WATER RESOURCES MANAGEMENT AND ADAPTATION TO CLIMATE CHANGE – Tunisia



Dr. Atef BEL HADJ ALI

Project coordinator / CRTEAN

GFSC, Washington , May 28 2013

project overview

- Project « LDAS TUNISIE »
 - funded by the **World Bank**
 - Technically supported by **NASA**
 - Managed by the **CRTEAN**

- Project agreed by WB **June 2011**
- Fund transferred to Crtean ; **August 2012**
- Starting workshop **31 January 2012**
 - with the presence of the NASA team and USAID (Shahid , Fritz, and Mark Peter)
 - CNCT, DGRE, DGACTA, Universities
- National Workshop : **22-23 November 2012**
 - with the presence of the AWC (Heba)
 - CNCT, DGRE, INM, DGACTA, IRA, Universities
 - Definition of technical teams
 - Definition of a an implementation plan

National Partners

- *National Center for mapping and remote sensing*
- *Ministry of agriculture*
 - *General Directorate of Water Resources (DGRE)*
 - *General Directorate of Rural Engineering and water exploitation (DGGREE)*
 - *Arid Region Institute (IRA)*
- *Ministry of transportation*
 - *National Institute of meteorology (INM)*
- *Universities and research labs.*

Objectives

- *Monitor the availability of water resources*
- *Monitor the agricultural activities, using evapotranspiration models*
- *Flood mapping, forecasting and monitoring*
- *Monitor the phenomenon of drought through the use of WISP tools*
- *Establish a mechanism for data dissemination*

Expected results of the project

- *Benefit from the contribution of coupled physical models of terrestrial and space observation for the quick estimation of hydrological parameters*
- *Optimize the use of water for irrigation through the monitoring of crop water needs using WISP tools and models*
- *Crop monitoring , yield estimation and drought monitoring/forecasting*
- *Monitor the impacts of climate change on the availability of water resources*
- *Improve the management and enhancement of groundwater monitoring*
- *flood mapping; monitoring and forecasting*

Project implementation

- phase 1 : *Identification and analysis of users needs*
- Phase 2 : *Capacity building*
- Phase 3 : *development and implementation*
- Phase 4 : *dessimination*

Topics / Teams

- Floods Mapping and Modeling
- Crop and Irrigation Mapping
- Drought & Evapotranspiration
- Climate Impact Analysis
- Ground water storage

Topics / Teams

Topic	Development institution	partners	Implementation institution
Floods Mapping and Modeling	CNCT	INM DGRE Universities/INAT	DGRE
Crop and Irrigation Mapping	CNCT	DGGREE DGPA INGC GDAs Universities	IRESA/DGRE
Drought & Evapotranspiration	IRA	CNCT IRA Universities	IRA
Climate Impact Analysis	INM	DGRE CNCT	INM
Ground water storage	DGRE	DGRE Regional CRDA	DGRE

Tâches réalisées/ Tasks performed

Equipes-responsables/ Teams leaders

- Floods Mapping and Modeling :: CNCT & DGRE
M. Sinan Bacha & M. Habib Chaieb
- Crop and Irrigation Mapping ; :: CNCT
Mrs. Thouraya Sahli
- Drought & Evapotranspiration :: IRA MEDNINE
Dr. Mohamed Ouassar
- Climate Impact Analysis :: INM – Mrs Soumaya
B. Rached
- Ground water storage :: DGRE - M. Habib Chaieb

Flood mapping & modeling

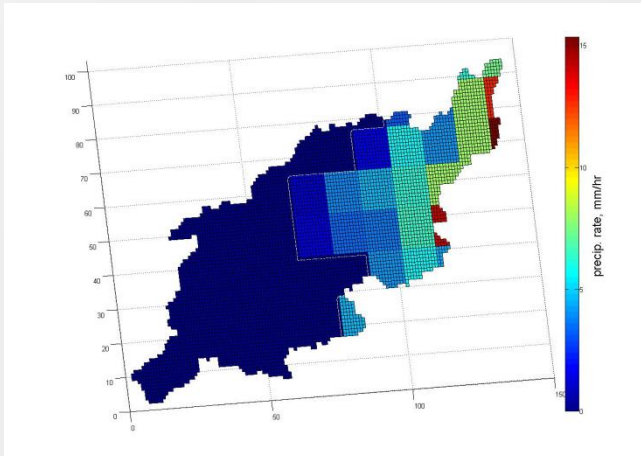
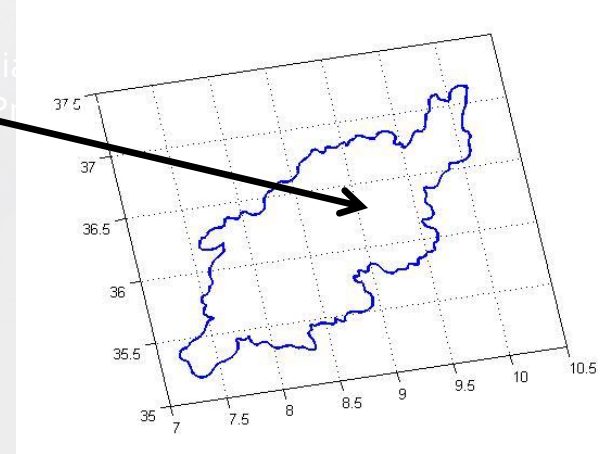
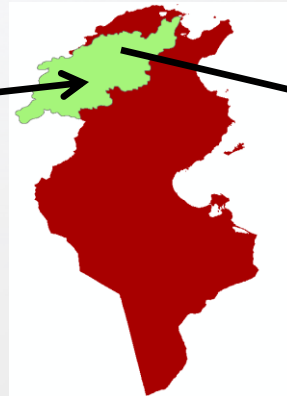
Tunisia has a dense hydrographic network in the north, whose river basins account for 81% of the national surface water potential. Oued Mejerda, which rises in Algeria, is the biggest river, with an annual water potential of around 0.8 billion m³. This region is prone to flooding events. Since these regions encompass a high socio-economic interest for the country, flood mitigation efforts are important to **minimize loss of human lives and property.**

Developing flood inundation and forecast maps – the ultimate purpose of this requirement is to provide these maps in a timely manner to the Tunisian organizations involved in the field of emergency management and disaster response. The inundations maps will be generated in near real time and provide the information on which geographic areas are impacted due to flooding. The forecast maps will provide early warning indication about areas, which may be under flood risk.

Application	NASA Role	Tunisian Team Role	Comments	Tentative Schedule	
				Start Date	Completion
NRT (250m) MODIS flood maps	NASA to generate and provide algorithms	CNCT to evaluate, and provide water mask information	http://oas.gsfc.nasa.gov/floodmap/ training on Crest model and transfer of model	1 st quarter 2013	4th quarter 2013
CREST global flood model	NASA assist in evaluation	CNCT to evaluate	Global Flood Model is at 12.5 degrees resolution: http://oas.gsfc.nasa.gov/CREST/global/ Training on crest model (4 th quarter 2013)	2 nd quarter 2013	4th quarter 2013
Regional Flood modeling	NASA to develop prototype 250m flood model for N. Africa. NASA to assist in evaluating CREST or LIS approach	CNCT to provide stream-gauge data and major dam locations and area, and perform customization.	Training on lis model (2 nd quarter 2014) and transfer of model	2 nd quarter 2013	Ongoing
Radar flood mapping	NASA to provide the algorithm	CNCT to approach CSA, others for radar data and evaluate.	Training on radar flood mapping Transfer of radar algorithms (1 st quarter 2015)	3 rd quarter 2014	Ongoing
Regional Flood Forecasting	TBD	CNCT to determine what precipitation forecast data is available from Meteorology Department.	Training on CREST model (in Tunisia) for stakeholders (1 st Quarter 2015)	1 st quarter 2015	Ongoing

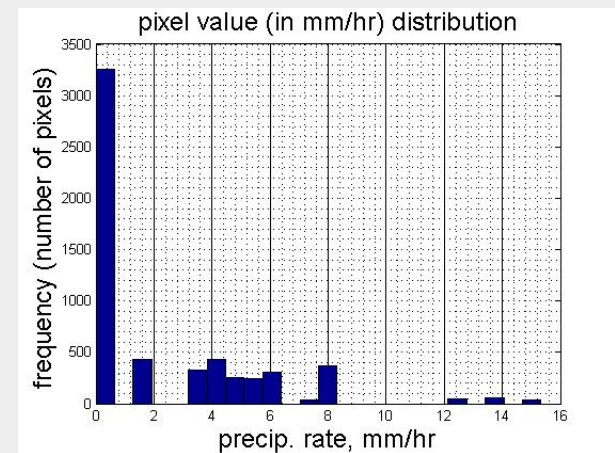
TMPA-RT Satellite Precipitation Data

Medjerda River Basin, northern Tunisia

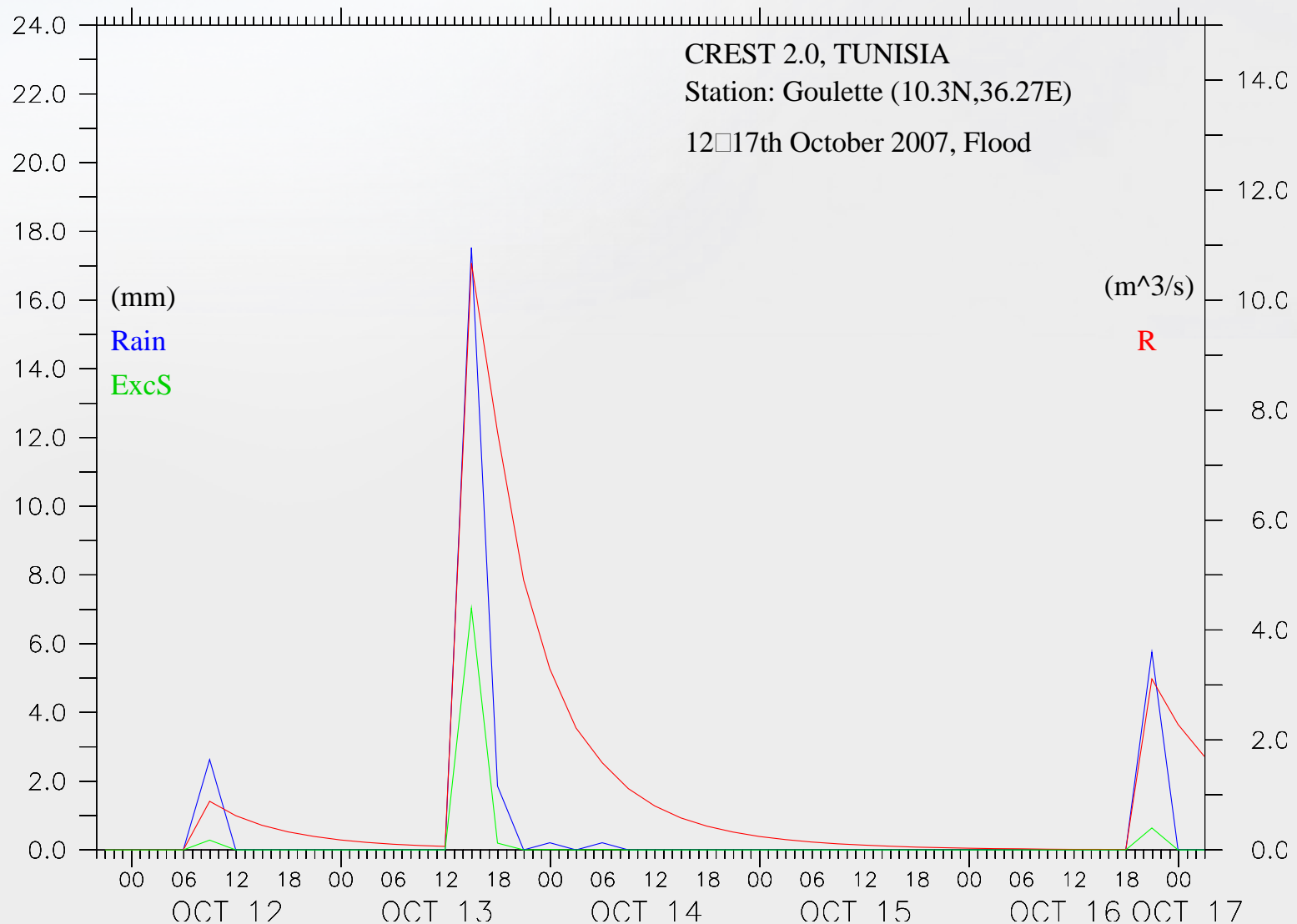


Left: Precipitation rates (mm/hr) over Medjerda River Basin, 10/13/2007, 18:00 Z

Right: Precipitation rate frequency distribution, Medjerda River basin, 10/13/2007, 18:00 Z



Flood over Tunisia- 13-17th October 2007, CREST 2.0 simulation



Irrigation & Crop mapping

The major actions by the Tunisian government are based on the following issues:

- Modernization of measurement tools and groundwater prospecting networks.
- Development of water resources by water-table artificial refill, desalinisation of brackish water or sea water for drinking water supply.
- Generalization of water saving techniques.
- Treated waste water reuse for irrigation purpose.
- And promotion of participatory management through water users associations.

Main issues

- improve water management for irrigation,
- insure water balance to satisfy water requirements of all development sectors of different regions,
- and to preserve underground water resources within sustainable development,
- monitoring of crop data (areas, yields, national production) to help decision makers on specific strategies aiming to food security.

Irrigation & Crop mapping

Application	NASA Role	CNCT Role	Comments	Tentative Schedule	
				Start Date	Completion
Digital GIS data sets for total area of cropland	Provide training to CNCT. Transfer the capability / model / software to CNCT.	CNCT to identify agriculture specialist(s) and create maps.	Training on crop mapping	2nd quarter 2013	Ongoing
Digital data sets for planted area of major crops including wheat, summer wheat, cotton, maize, and vegetables	Provide training to CNCT. Transfer the capability / model / software to CNCT.	CNCT to identify GIS specialist(s) and create data sets.	Training on LIS model	3 rd quarter 2013	Ongoing
Digital data sets for extent of irrigation for each crop type	Provide training to CNCT. Transfer the capability / model / software to CNCT.	CNCT to identify crop type, location of example crops to be mapped, and irrigation status from GIS digital data sets. CNCT to create data sets.		1 st quarter 2014	Ongoing
Development and adaptation of biophysical crop models for yield modeling and climate change assessment	Provide training to CNCT. Transfer the capability / model / software to CNCT.	Customize and adapt the model; and validate.	<ul style="list-style-type: none"> • Training on Dis-Alexi.model (1st quarter 2014) • Training on a Crop modeling (DsSat) (4th quarter 2014) • Training on Crop modeling for stakeholders in Tunisia (1st quarter 2015) • Training on Alexi Dis-Alexi using and products for stakeholders in Tunisia (1st quarter 2015) 	3rd quarter 2013	Ongoing

Drought monitoring

User Needs / Goals

- Provide reliable and easily exploitable information characterizing spatial and temporal extension of drought (duration, intensity, scale, etc.) and drought impact Three principal components are to be considered: early warning system, a risk evaluation system and mitigation/adaptation system.
- Development and calculation of Vegetation monitoring indicators (standardized vegetation index, vegetation condition index, temperature condition index, vegetation health index, vegetation drought index, water stress vegetation index) with the following specifications: 1 km spatial resolution; 10-day synthesis temporal resolution; monthly and 10-day product frequency; raster (Tiff, img) format at national scale; input data: AVHRR data used since 1999 and other sources to be explored: MODIS, Spot VGT.
- Soil moisture prediction using radiometric signal changes of terrestrial surface temperature.

Support needed from NASA

- Mapping of evapotranspiration and surface temperature on large spatial scale(national scale) using ALEXI (model Atmosphere-Land-EXchange Inversion) (Anderson et al., 1997; Mecikalski et al. 199) and GEOS images (spatial resolution 5-10 Km)..
- The Disaggregated ALEXI (DisALEXI) algorithm using high-resolution surface temperature and vegetation cover information will be used to disaggregate the 5-10 km flux predictions from ALEXI down to the 30-300 m scale for direct comparison with ground-based measurements. This model will use data at a local scale (spatial resolution 30-1000m) based on MODIS and Landsat images.

Drought monitoring

Application/Action	NASA Role	Tunisian team Role	Comments	Tentative Schedule	
				Start Date	Completion
Literature review on drought early warning systems	Reviewing	Task to be carried out by the Tunisian partners. IRA takes the lead.		2 nd quarter 2013	ongoing
Alexi ET and anomaly (3km, daily, NRT) maps	NASA / USDA to generate	INM (Northern region) and IRA (central and southern regions) to validate,	USDA training in Tunis and/or at USDA (1 st quarter 2014, and model transfer to Tunisian team)	2 nd quarter 2013	Ongoing
MODIS ET 1 km, daily NRT	NASA to investigate	INM (Northern region) and IRA (central and southern regions) to validate, USDA training in Tunis and/or at USDA (3 rd quarter 2013)	NASA generated product (Univ. of Montana - Steve Running algorithm)	2 nd quarter 2013	
Disalexi (90m, NRT, produced at CNCT)	NASA / USDA to generate	INM (Northern region) and IRA (central and southern regions) to validate, USDA training in Tunis (1 st quarter 2014)		3 rd quarter 2013	4 th quarter 2015
LIS ET, SM, ground water level (1 km, daily nowcast)	NASA provided hydrological model	Produced via DGRE validated and calibrated model	Training on Lis model (2 nd quarter 2014)	4 th quarter 2013	4 th quarter 2015
Precipitation data and forecast	NASA can provide TRMM and GEOS-5 data	INM to provide data storage and management	NASA's future GPM satellite data. CNCT to provide precipitation forecast from their Meteorology Office	2 nd quarter 2013	
Soil moisture satellite products			From NASA's future SMAP satellite. CNCT can contact ESA for SMOS data.	1 st quarter 2014	ongoing
fAPAR (& fAPAR anomaly) calculation (1 km, 10 days)	TBD	CNCT/IRA to calculate fAPAR	Contacts with JRC will be established by CNCT to investigate eventual partnership	1 st quarter 2014	ongoing
MODIS NDWI* (1 km, 10 days)	TBD	CNCT to calculate, IRA to validate		1 st quarter 2014	ongoing
Calculation of Combined Drought Indicator (CDI) using SPI, soil moisture & fAPAR	TBD	INM and CNCT to calculate this indicator using the generated parameters above (SPI, SM & fAPAR)	International expertise will be engaged for the methodology development and adaptation to the Tunisian context	3 rd quarter 2014	ongoing

Climate change

Application	NASA Role	Tunisian Team Role	Comments	Tentative Schedule	
				Start Date	Completion
Open source downscaling code for MENA	NASA / JHU to provide downscaling scripts. Transfer of downscaling code to INM WISP. Provide documentation and initial support for implementation.	INM to execute the script and customize	Training in ICBA and transfer of scripts	3rd quarter 2013	Ongoing
Statistically downscaled climate projections for MENA	Produced at <10km resolution with the option for higher resolution analysis in countries with sufficient in situ data to support the analysis. Projections will be performed for middle and high emissions scenarios and for multiple GCM realizations.	Evaluate utility of climate projection data including for use in LIS.	Training on LIS MODEL use	1st quarter 2014	Ongoing
Dynamic downscaling	Investigate the feasibility of providing NASA climate projections from GISS and GMAO climate model runs.	Work with ICBA to adopt and adapt dynamic methods of downscaling such as WRF. Training for Tunisian team	Will require the use of super calculator machine of NASA or ICBA!.	1 st quarter 2014	ongoing

Ground Water Storage

Application	NASA Role	Tunisian team Role	Comments	Tentative Schedule	
				Start Date	Completion
to develop the water balance of groundwater basins : Abstraction and recharge	Provide model	provide hydrogeological data (historical of groundwater levels,)	CRTEAN, World Bank and NASA to discuss with ICBA and sign agreement.	3 rd quarter 2013	4 th quarter 2013
LIS model	Technical assistance	To evaluate		4 th quarter 2013	ongoing
Training on storage modeling (LIS)		1. To select trainees		1 st quarter 2014	
Ground water storage and recharge modeling	NASA/ICBA to develop prototype model for : <ul style="list-style-type: none"> - Grombalia aquifer, - North-Gafsa aquifer, - Sidi Bouzid aquifer, - Kairouan aquifer, - North and South Gabes aquifers. NASA/ICBA to assist in evaluating: <ul style="list-style-type: none"> - LIS, LDAS - Others models 	to provide piezometric data and area to perform customization for visualization results and model development on prototype to evaluate: <ul style="list-style-type: none"> - LIS, - LDAS, - Others models 	Additional resources required for Tunisia for NASA contractor	3 rd quarter 2013	Ongoing
Ground water storage and recharge modeling	NASA to provide the algorithm and to perform training on ground water storage by jan 2014	to approach for ground water data and evaluate. To select trainees	Approximately 12 months required to prepare the algorithms for transfer	1 st quarter 2014	Ongoing
Regional Ground water storage and recharge evaluation	TBD	DGRE to determine what hydrogeological data is available from DGRE and CRDA.	method ?	2 nd Quarter 2014	ongoing

Programmatic

Application	NASA Role	tunisian Role	Comments	Tentative Schedule	
				Start Date	Completion
Annual all stakeholders workshop	NASA to present initial plan.	Tunisian team to implement the plan.		Once a year	
Website development	NASA to assist Tunisian team to elaborate website specifications.	CNCT to provide content and to implement it.		4th quarter 2013	Ongoing
Develop GIS based web applications for visualization system	NASA to assist the development of GIS based system that will visualize results of all applications in NRT at both central and regional level.	CNCT to procure hardware and software. Develop web specific applications utilizing the system.		1st quarter 2014	Ongoing

Applications and products

Application	Type and Location of User	Products Needed	Frequency	Display Format	Communication Method
Flood Mapping	CNCT <ul style="list-style-type: none"> Central 	250m NRT Flood maps	2 x day (cloud free)	JPEG, shapefile, KML	Internet / website / internal network
Flood Modeling	DGRE <ul style="list-style-type: none"> Central 	250m NRT Nowcasts and Forecasts of Flood Extent and stream flow	Every 3 hours		Internet / website /
Crop mapping	CNCT	Crop Maps ET MAPS	TBD	Jpeg, shapefile	Internet / Website
Crop yield estimation	DGPA	Maps + reports	TBD		Internal Network
Climate Changes	INM	CC projection	TBD	Digital maps reports	Internet / Website
Drought monitoring	IRA	Drought Monitoring	TBD		Internet Website

Merci pour votre attention

***Thank you
for your attention***